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Indian Standard

MINIATURE FUSES

PART 4 UNIVERSAL MODULAR FUSE-LINKS (UMF) — THROUGH-HOLE AND SURFACE MOUNT TYPES

ICS 29.120.50

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 2009

Price Group 10

NATIONAL FOREWORD

This Indian Standard (Part 4) which is identical with IEC 60127-4 : 2005 'Miniature fuses — Part 4: Universal modular fuse-links (UMF) — Through-hole and surface mount types' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Fuses Sectional Committee and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, references appear to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60068-2-20 : 1979 Basic environmental testing procedures — Part 2 : Tests — Test T: Soldering	IS 9000 (Part XVIII/Sec 1 to 3) : 1981 Basic environmental testing procedures for electronic and electrical items: Part XVIII Solderability test	Technically Equivalent
IEC 60068-2-21 : 1999 Environmental testing — Part 2-21: Tests — Test U: Robustness of terminations and integral mounting devices	IS 9000 (Part 19/Sec 1 to 5) : 1986 Basic environmental testing procedures for electronic and electrical items: Part 19 Test U: Robustness of terminations and integral mounting devices (*first revision*)	do
IEC 60127-1 : 1988[1] Miniature fuses — Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links	IS/IEC 60127-1 : 2006 Miniature fuses: Part 1 Definitions for miniature fuses and general requirements for miniature fuse-links (*first revision*)	do
IEC 60664-1 : 1992[2] Insulation coordination for equipment within low-voltage systems — Part 1 : Principles, requirements and tests	IS 15382 (Part 1) : 2003 Insulation coordination for equipment within low-voltage systems: Part 1 Principles, requirements and tests	do
ISO 3 : 1973 Preferred numbers — Series of preferred numbers	IS 1076 (Part 1) : 1985 Preferred numbers: Part 1 Series of preferred numbers (*second revision*)	Identical

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

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[1] Since revised in 2006 and adopted as IS/IEC 60127-1 : 2006.

[2] Since revised in 2002 and adopted as IS 15382 (Part 1) : 2003.

(*Continued on third cover*)

Indian Standard

MINIATURE FUSES

PART 4 UNIVERSAL MODULAR FUSE-LINKS (UMF) — THROUGH-HOLE AND SURFACE MOUNT TYPES

1 Scope and object

This part of IEC 60127 relates to universal modular fuse-links (UMF) for printed circuits and other substrate systems, used for the protection of electric appliances, electronic equipment, and component parts thereof, normally intended to be used indoors.

It does not apply to fuse-links for appliances intended to be used under special conditions, such as in a corrosive or explosive atmosphere.

These fuses are normally intended to be mounted or replaced only by appropriately skilled persons using specialized equipment.

Fuse-links for use in fuse-holders are under consideration.

This standard applies in addition to the requirements of IEC 60127-1.

The objectives of this part of IEC 60127 are as given in IEC 60127-1, with the additional requirement of a degree of non-interchangeability.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-20:1979, *Basic environmental testing procedures – Part 2: Tests – Test T: Soldering*
Amendment 2 (1987)

IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-58:2004, *Environmental testing – Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

IEC 60127-1:1988, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links* [1]
Amendment 1 (1999)
Amendment 2 (2002)

IEC 60194:1999, *Printed board design, manufacture and assembly – Terms and definitions*

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[1] There exists a consolidated version (2003).

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests* [2]
Amendment 1 (2000)
Amendment 2 (2002)

IEC 61249-2-7:2002, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 3 of IEC 60127-1, together with the following definitions, apply.

3.1

through-hole fuse-link
UMF designed for soldering directly into a printed wiring board, with insertion of its leads in suitably designed holes

3.2

surface mount fuse-link
UMF designed for direct conductive attachment by solder or other means on to the surface of a substrate, without insertion of its leads in suitably designed holes or sockets

3.3

land
portion of a conductive pattern usually but not exclusively used for the connection and/or attachment of components (see IEC 60194)

NOTE Further definitions which may be useful in the application of surface mount fuse-links may be found in IEC 60115-1 and IEC 60115-8[3].

4 General requirements

See IEC 60127-1.

5 Standard ratings

5.1 Rated voltage

See standard sheets.

5.2 Rated current

See Table 1 for preferred ratings.

5.3 Rated breaking capacity

See standard sheets.

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[2] There exists a consolidated version (2002).

[3] This standard has been withdrawn.

6 Marking

In addition to the requirements of Clause 6 in IEC 60127-1, the following criteria concerning UMF shall be observed and marked:

6.1 *Addition:*

e) For fuse-links rated at 250 V, a symbol denoting the breaking capacity. This symbol shall be placed between the marking for rated current and the marking for rated voltage.

These symbols are as follows:

H: denoting high-breaking capacity;

I: denoting intermediate-breaking capacity;

L: denoting low-breaking capacity.

f) The distinctive symbol shown in Figure 1.

g) The letters a.c. before the voltage for devices designed solely for alternating current application.

6.4 Colour coding for universal modular fuse-links

Under consideration.

6.5 Where marking is impractical due to space limitations, the relevant information should appear on the smallest package and in the manufacturer's technical literature.

7 General notes on tests

In addition to the requirements of Clause 7 in IEC 60127-1, the following criteria shall be observed:

7.2 *Addition*:

7.2.1 For testing of individual fuse ratings according to standard sheets 1 and 2, see Table 2. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 63. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are nine spares.

For the maximum ampere rating of a homogeneous series according to standard sheets 1 and 2, see Table 3. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 53. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are 19 spares.

For the minimum ampere rating of a homogeneous series according to standard sheets 1 and 2, see Table 4. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 38. For fuse-links designed only for a.c., the number of fuse-links required is 33. There are 16 spares.

7.3 Fuse-bases for tests

7.3.1 General requirements

Fuse-links shall be mounted upon the appropriate test board (see 7.3.2 or 7.3.3 as appropriate) by soldering.

This test board shall then be mounted on the test fuse-base (Figure 4). The test board shall be made of epoxide woven glass fabric copper-clad laminated sheet, as defined in IEC 61249-2-7:

- the nominal sheet thickness shall be 1,6 mm;
- the nominal thickness of copper layer shall be 0,035 mm (0,070 mm above 6,3 A).

Metal parts of the fuse-base shall be made of brass with a copper content between 58 % and 70 %. Contact parts shall be silver-plated.

When two or more fuse-links are tested in series, the test fuse-bases shall be located so that there will be a spacing of not less than 50 mm between any two fuse-links under test. The conductor connecting the test fuse-bases together, and connecting the test fuse-bases to the ammeter and the source of supply shall be insulated copper wire. The length of each conductor shall be 250 mm, and the cross-sectional area of the wire shall be approximately 1 mm^2.

7.3.2 Through-hole fuse-links (standard sheet 1)

For electrical tests upon fuse-links covered by standard sheet 1, the fuse-link shall be mounted on the test board, as shown in Figure 2 in the pair of holes appropriate to the spacing of the terminations.

7.3.3 Surface mount fuse-links (standard sheet 2)

For electrical tests upon fuse-links covered by standard sheet 2, the fuse-link shall be mounted on the test board, as shown in Figure 3. See Annex A for guidance.

8 Dimensions and construction

8.1 Dimensions

The dimensions of the UMFs shall comply with the relevant standard sheets.

Compliance is checked by measurement of length, width and height.

For fuse-links to standard sheet 1, the termination spacing is checked. The termination shall also pass through a 1 mm hole. The length of the termination is not specified as this is subject to the method of packaging.

8.2 Construction

The fuse-element shall be completely enclosed.

The UMF shall withstand the heat and chemical exposure of a printed circuit board or other substrate assembly operations with its performance unimpaired.

Compliance is checked by the resistance to soldering heat test as specified in 8.7.

8.3 Terminations

8.3.1 Through-hole fuse-links

Terminations shall be firmly attached so that it is not possible to remove them without damaging the UMF.

Compliance is checked by carrying out the following test.

The samples are preconditioned by immersion in water for 24 h at a temperature between 15 °C and 35 °C.

The tests are carried out in accordance with IEC 60068-2-21.

The following tests shall be applied:

- tensile test Ua_1, applied force 10 N;
- thrust test Ua_2, applied force 2 N;
- bending test Ub, applied force 5 N, number of bends: 1.

The sample size is two fuses for each test. After testing, the terminations shall remain firmly attached. The voltage drop shall be measured in accordance with 9.1, and shall not exceed the maximum allowed in Table 1. Bending test Ub is omitted if the terminations are less than 5 mm.

8.3.2 Surface mount fuse-links

The fuse-links shall be mounted on the test board as shown in Figure 3. The test board, with the fuse-links on the underside, shall be placed in the bending jig as shown in Figure 5. The board shall then be bent by 1 mm at a rate of 1 mm/s. The test board shall be allowed to recover from the bent position, and then be removed from the test jig.

After the test, the terminations shall remain firmly attached, and the voltage drop shall be measured in accordance with 9.1, and shall not exceed the maximum allowed in Table 1.

8.4 Alignment and configuration of terminations

The termination configuration and spacing shall be as specified in the standard sheets.

NOTE 1 Through-hole fuse-links

For through-hole mounting of UMFs (standard sheet 1), the dimensions shown on the standard sheets are such as to permit installation on printed circuit boards having a grid system of holes located on centres of distance e = 2,5 mm. Attention is drawn to the fact that in some parts of the world the value e = 2,54 mm is still in use by printed circuit designers.

Electrical and electronic circuit designers are advised to apply the requirements of IEC 60326-3.

NOTE 2 Surface mount fuse-links

For surface mounting of UMFs (standard sheet 2), electrical and electronic circuit designers are advised to design substrate land areas to receive UMFs with due consideration for achieving the maximum area of contact in the application, taking into account the tolerance applied to mechanical placing of the component and the dimensions and tolerances for terminals in this standard.

8.5 Soldered joints

See IEC 60127-1.

8.6 Solderability of terminations

8.6.1 Through-hole fuse-links

The fuse-links shall be subjected to Test Ta of IEC 60068-2-20, using Method 1, with the following conditions:

Ageing: None (as received)
Immersion conditions: 235 °C ± 5 °C, 2 s ± 0,5 s
Depth of immersion: 2,0 mm ± 0,5 mm (from seating plane)
Flux type: Non-activated
Screen: A screen should be used.

After the test, the dipped surface shall be covered with a smooth and bright solder coating, with no more than small amounts of scattered imperfections such as pin-holes or unwetted or dewetted areas. These imperfections shall not be concentrated in one area. 10× magnification shall be used.

8.6.2 Surface mount fuse-links

The fuse-links shall be subjected to Test Td of IEC 60068-2-58, with the following conditions:

Ageing: None (as received)
Immersion conditions: 235 °C ± 5 °C, 2 s ± 0,2 s for wave soldering application
215 °C ± 3 °C, 3 s ± 0,3 s for reflow soldering application
Depth of immersion: The terminations shall be immersed successively in such a way that the entire metal surfaces are covered by the solder bath
Flux type: Non-activated

After the test, the contact areas shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pin-holes or unwetted or dewetted areas. These imperfections shall not be concentrated in one area. 10× magnification shall be used.

8.7 Resistance to soldering heat

8.7.1 Through-hole fuse-links

The fuse-links shall be subjected to Test Tb of IEC 60068-2-20, Method 1A, with the following conditions:

Ageing: None (as received)
Immersion conditions: 260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion: 2,0 mm ± 0,5 mm (from seating plane)
Flux type: Activated
Screen: A screen should be used.

After the test, the fuse-link shall not be cracked. Marking shall be readable, and colour coding, if used, shall not have changed colour.

The voltage drop is measured as specified in 9.1, and shall not exceed the maximum values specified in Table 1.

8.7.2 Surface mount fuse-links

The fuse-links shall be subjected to Test Td of IEC 60068-2-58.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	10 mm
Flux type:	Activated

After the test, the fuse-link shall not be cracked. Marking shall be readable and colour coding, if used, shall not have changed colour.

The voltage drop is measured as specified in 9.1, and shall not exceed the maximum values specified in Table 1.

NOTE For some designs, it may be necessary to use a less severe test. This should be in accordance with the manufacturer's recommendations, and should be recorded in the test report.

9 Electrical requirements

9.1 Voltage drop

For measurement of voltage drop, see IEC 60127-1.

The voltage drop shall be measured at the points marked U in Figure 2 for through-hole fuse-links and in Figure 3 for surface mount fuse-links, using the test fuse-base shown in Figure 4 (see 7.3).

Values given in Table 1 apply.

9.2 Time/current characteristics

9.2.1 Time/current characteristics at normal ambient temperature

At 1,25 times rated current not less than 1 h (after completing endurance test).

At 2 times rated current not exceeding 2 min.

Pre-arcing time at 10 times rated current according to the following types:

Type FF:	less than 0,001 s
Type F:	from 0,001 s to 0,01 s
Type T:	greater than 0,01 s to 0,1 s
Type TT:	greater than 0,100 s to 1,00 s

9.2.2 Test at elevated temperature

None specified.

9.2.3 Test procedure

See IEC 60127-1.

9.2.4 Presentation of results

See IEC 60127-1.

9.3 Breaking capacity

9.3.1 *Addition:*

In the case of fuse-links in which any component is organic (such as with a moulded body), the recovery voltage shall be maintained for 5 min after the fuse has operated.

Typical test circuits for a.c. and d.c. are given in Figure 6.

For low-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be greater than 0,95. To obtain this result, the circuit current shall be adjusted by the use of resistors of negligible inductance.

For intermediate-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be between 0,8 and 0,9.

For high-breaking capacity fuse-links, the power factor of the a.c. test circuit shall be between 0,7 and 0,8.

The time constant of the d.c. test circuit for low-breaking capacity fuse-links shall be less than 1 ms. To obtain this result, the circuit current shall be adjusted by the use of resistors of negligible inductance; additionally, the total inductance of the test circuit and source of supply shall be less than 1 mH.

The time constant for the d.c. test circuit for intermediate-breaking capacity fuses shall be 1,5 ms ${}^{+10}_{\ 0}$ % and for high-breaking capacity it shall be 2,3 ms ${}^{+10}_{\ 0}$ %.

Where difficulties in testing arise, these limits may be exceeded with the permission of the manufacturer. For tests at lower prospective currents, the inductance of the circuit shall remain constant and the current shall be adjusted by changing the resistance only.

9.3.2 Criteria for satisfactory performance

Addition:

The UMF shall operate satisfactorily without any of the following phenomena:

- illegibility of marking after test.

The following phenomena are neglected:

- black spots or other marks on the fuse-link terminations.

9.3.3

Replacement:

After the breaking capacity test, the insulation resistance shall be measured with a d.c. voltage equal to twice the rated voltage of the fuse-link. The resistance shall not be less than 0,1 MΩ.

9.4 Endurance tests

See IEC 60127-1.

9.5 Maximum sustained dissipation

See IEC 60127-1.

9.6 Pulse tests

None specified.

9.7 Fuse-link temperature

Replacement:

In place of the test in 9.7 of IEC 60127-1, the following test is performed during the final 5 min of the endurance test at 1,25 I_N:

a) for fuse-links according to standard sheet 1 the temperature rise above ambient temperature shall be measured at the hottest spot found on the surface of the fuse-link, using a fine wire thermocouple (or other measuring methods that do not appreciably affect the temperature). The temperature rise shall not exceed 70 K for rated current up to and including 6,3 A, and 85 K for rated current above 6,3 A;

b) for fuse-links according to standard sheet 2 the temperature rise above ambient temperature shall be measured on the terminals of the fuse-link soldered to the relevant test board, using a fine wire thermocouple not larger than 0,21 mm^2 (or other measuring methods that do not appreciably affect the temperature). The temperature rise shall not exceed 85 K.

9.8 Operating overvoltage

During the breaking capacity tests, the voltage across the fuse shall be monitored by a suitable oscilloscope and probe system, operated in such a way as to indicate and record the voltage for a time which includes the interval from the moment of closure of the contactor until current through the fuse-link is extinguished to a value of less than 10 mA (a suitable oscilloscope should be capable of recording any overvoltage that persists for 5 µs or longer).

The maximum voltage in the interval shall be recorded. In no case shall it be higher than the value of maximum operating overvoltage given on the standard sheet.

Table 1 – Maximum values of voltage drop and sustained dissipation

Rated current	Maximum voltage drop mV	Maximum sustained dissipation mW
32 mA	Under consideration	Under consideration
50 mA	Under consideration	Under consideration
63 mA	Under consideration	Under consideration
80 mA	Under consideration	Under consideration
100 mA	1 300	200
125 mA	1 000	200
160 mA	1 000	240
200 mA	1 000	500
250 mA	800	500
315 mA	750	500
400 mA	700	500
500 mA	600	500
630 mA	500	500
800 mA	400	500
1 A	300	500
1,25 A	300	1 000
1,6 A	300	1 000
2 A	300	1 000
2,5 A	300	1 200
3,15 A	300	1 500
4 A	300	2 000
5 A	300	2 500
6,3 A	300	3000
8 A	220	3000
10 A	220	3500

If intermediate rated currents are required, they shall be chosen from the series R20 or R40 according to ISO 3.

NOTE The values indicated in Table 1 apply to low-breaking capacity only. Values for intermediate-breaking capacity and high-breaking capacity are under consideration.

Table 2 – Testing schedule for individual ampere ratings

Subclause	Description		Universal modular fuse-link number																				
			1	4	7	10	13	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61
			2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59	62
			3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
9.7	Temperature rise						X	X															
9.5	Maximum sustained dissipation						X	X															
9.4	Endurance test						X	X															
9.2.1	Time/current characteristic	$10\ I_N$												X									
		$2\ I_N$																					X
		$1{,}25\ I_N$					X	X															
9.3	Breaking capacity																						
	Rated breaking capacity	a.c.								X													
		d.c.									X												
	5 times the rated current	a.c.										X											
		d.c.											X										
	10 times the rated current	a.c.														X							
		d.c.															X						
	50 times the rated current	a.c.																X					
		d.c.																	X				
	250 times the rated current	a.c.																			X		
		d.c.																				X	
9.3.3	Insulation resistance									X	X	X	X			X	X	X	X		X	X	
8.3	Fuse-link terminations		X	X																			
8.5	Soldered joints						X	X						X									X
6.2 [a]	Legibility and indelibility of marking						X	X						X									X
8.6	Solderability				X																		
8.7	Resistance to soldering heat					X																	

A total of 63 fuse-links (48 for a.c. use only, omit d.c. breaking capacity samples) of which nine are kept as spares. Samples 1 to 12 are chosen at random.

Samples 13 to 63 (48) are soldered to the appropriate test board and sorted in descending order of voltage drop.

[a] This subclause is to be found in IEC 60127-1.

Table 4 – Testing schedule for minimum ampere rating of a homogeneous series

Subclause	Description		Fuse-link numbers in decreasing value of voltage drop							
			1-6	7 8 9	10 11 12	13-17	18-22	23-32	33 34 35	36 37 38
9.4	Endurance test		X							
9.2.1	Time/current characteristics	10 I_N		X						
		2 I_N							X	
9.3	Rated breaking capacity	a.c.				X				
		d.c. (if applicable)					X			

A total of 38 fuse-links (33 for a.c. use only, omit d.c. breaking capacity samples) of which 16 are kept as spares.

The samples are soldered to the test board and sorted in descending order of voltage drop.

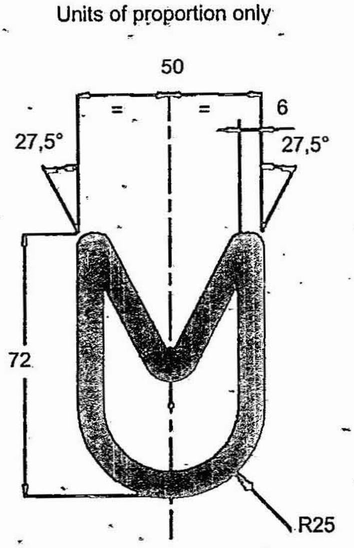
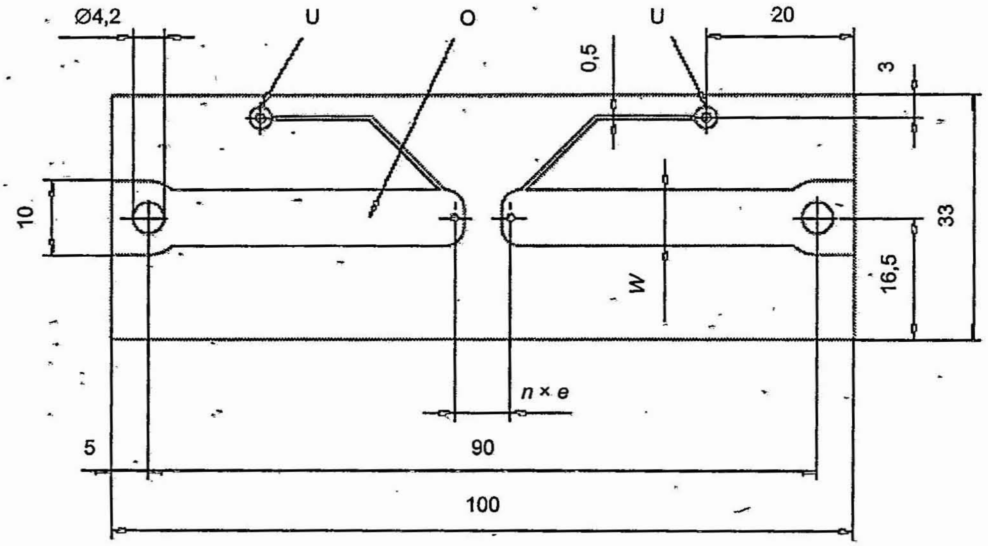


Figure 1 – Unique identifying symbol for UMFs

Dimensions in millimetres

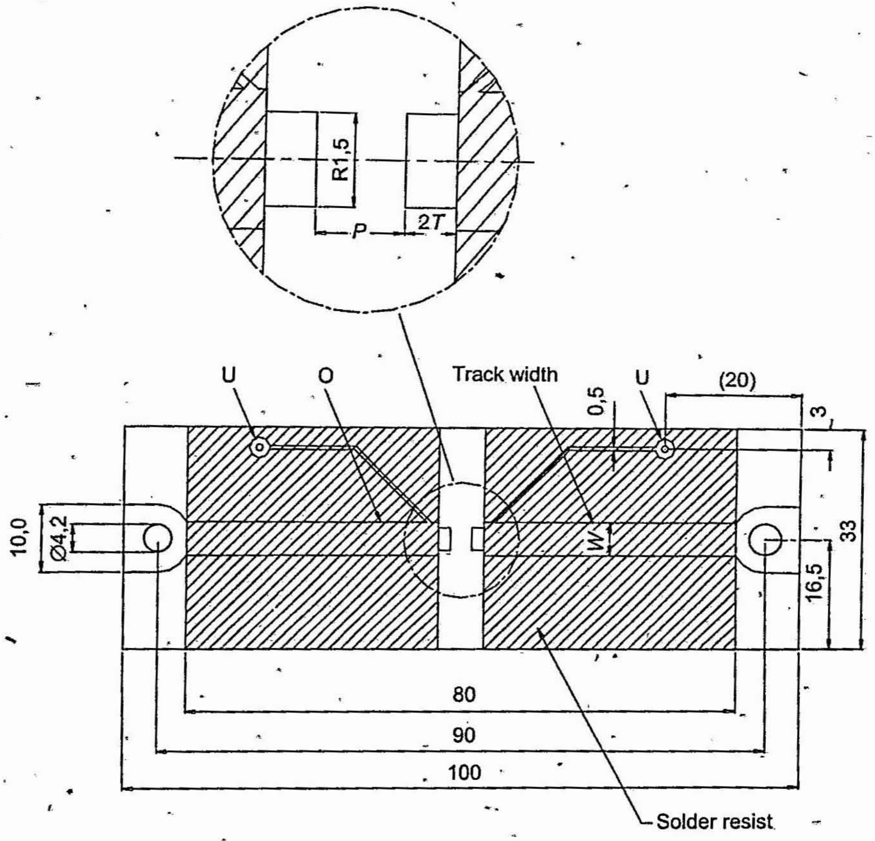


Key

- O copper layer, thickness 0,035 mm (0,070 mm for rated currents above 6,3 A)
- U connection for voltage drop measurement
- *n* 1, 2, 3, 4 or 5
- *e* 2,50 mm
- *W* 5,0 mm for rated current up to and including 6,3 A
  7,5 mm for rated current above 6,3 A

NOTE A mechanical device may be used as long as it is demonstrated that the results are the same.

Figure 2 – Test board for through-hole fuse-links



Key

O	copper layer, thickness 0,035 mm (0,070 mm for rated currents above 6,3 A)
U	connection for voltage drop measurement
W	5,0 mm (7,5 mm for rated currents above 6,3 A). For small devices, it may be necessary to use reduced track widths, representing normal use of these devices. This should be recorded in the test report and in the manufacturer's literature.
P	terminal spacing
R	refer to standard sheet 2, page 1
T	refer to standard sheet 2, page 1

NOTE 1 Solder resist to be applied in hatched areas.

NOTE 2 The land areas should be suitably prepared for soldering.

NOTE 3 A mechanical device may be used as long as it is demonstrated that the results are the same (not applicable to 8.7).

Figure 3 – Test board for surface mount fuse-links

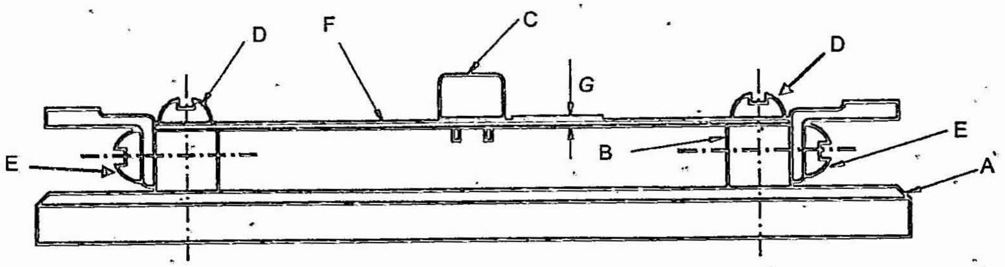


Figure 4a – Through-hole fuse-link (printed circuit track underneath)

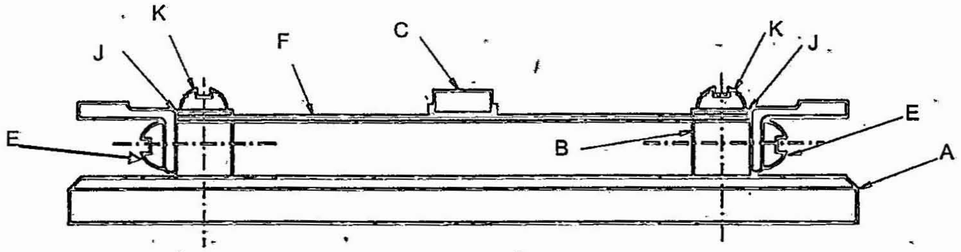
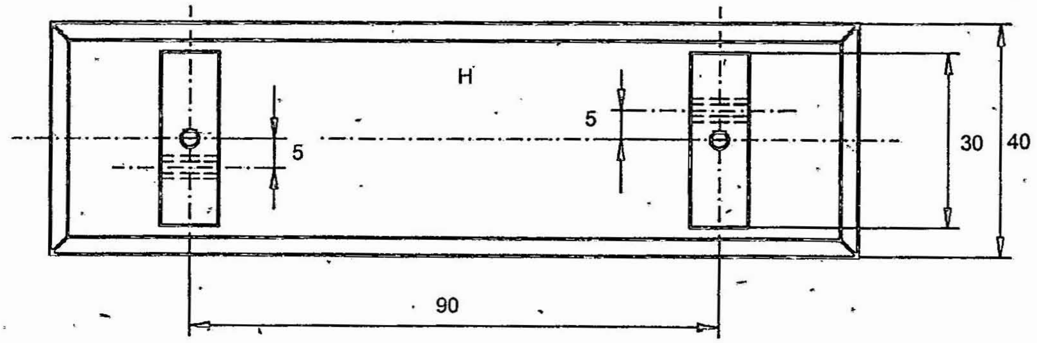


Figure 4b – Surface mount fuse-link (printed circuit track on top)

Dimensions in millimetres



Key

A base of low heat conducting material, thickness 10 mm

B brass electrodes 10 mm x 10 mm

C UMF soldered in place

D fixing screws

E contact screws holding solder terminal

F printed circuit board (see Figures 2 and 3)

G space between UMF body and board equals (0,5 ± 0,25) mm

H top view of base with brass electrodes

J silver-plated brass washer (two places)

K silver-plated brass screw to make contact with the conducting surface on top of the printed circuit board (two places)

Figure 4 – Test fuse base

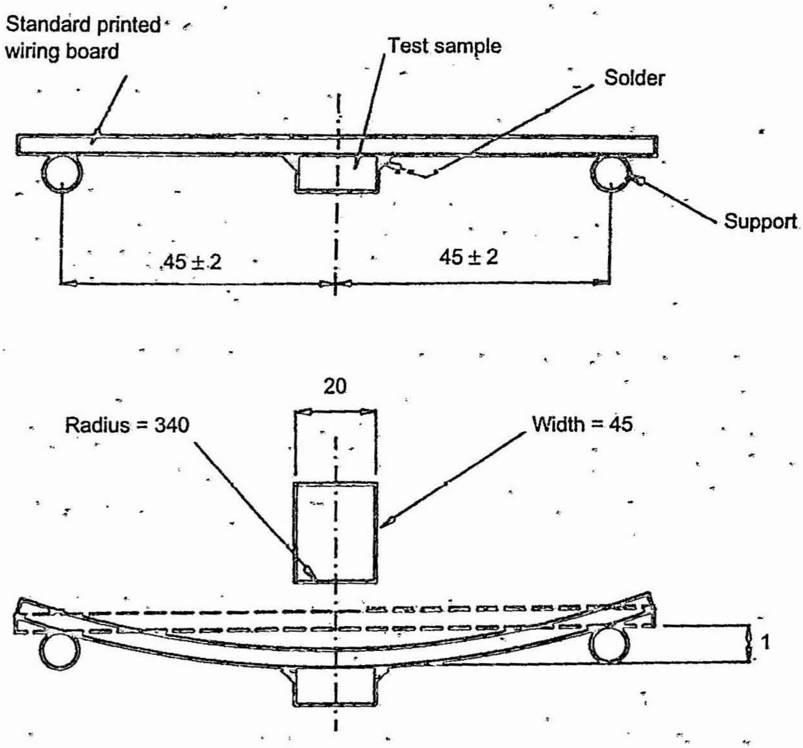


Figure 5 – Bending jig for surface mount fuse-links

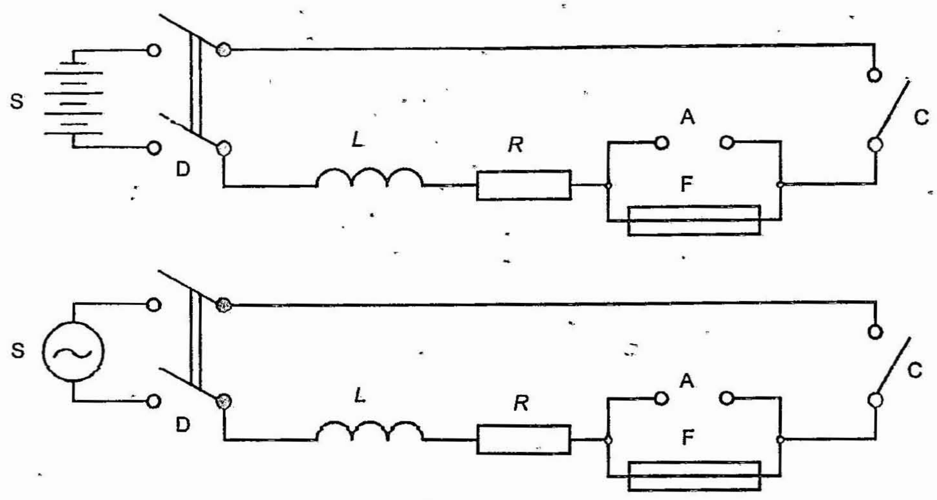


Figure 6a – Typical test circuit for breaking capacity tests for high-breaking capacity and intermediate-breaking capacity fuse-links

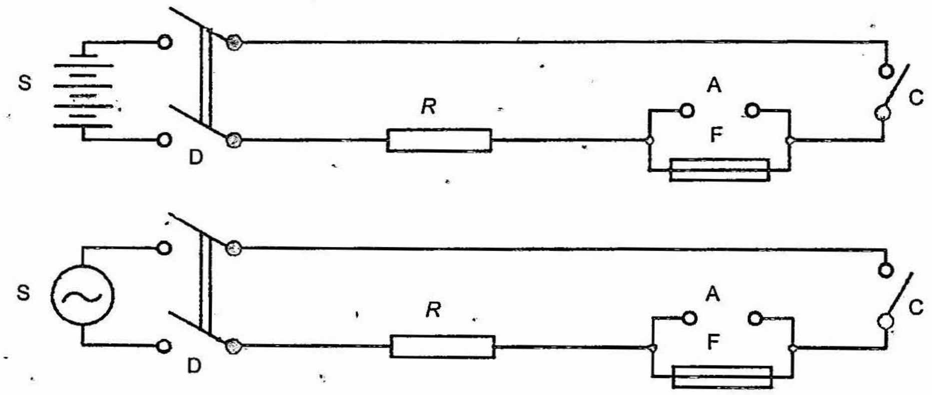


Figure 6b – Typical test circuit for breaking capacity tests for low-breaking capacity fuse-links

Components

A	removable link used for calibration
C	contactor that makes the circuit
D	switch to disconnect the source of supply
F	fuse under test
S	source of supply, impedance less than 10 % of the total impedance of the circuit
L	air-cored inductance
R	series resistor, adjusted to obtain correct prospective current

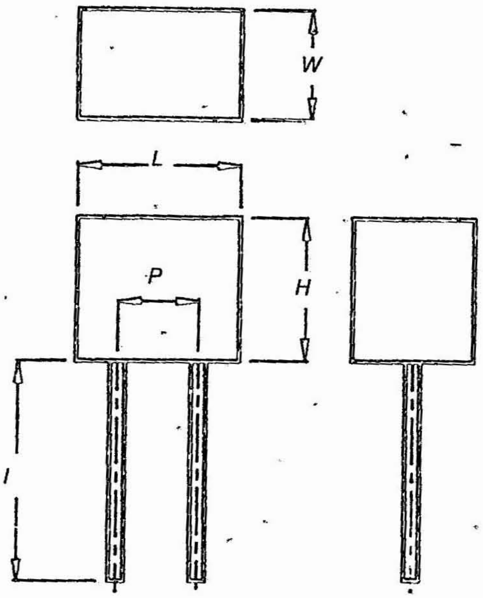
Figure 6 – Test circuits for breaking capacity tests

10 Standard sheets

10.1 Standard sheet 1 – Through-hole fuse-links

	Through-hole fuse-links	**Standard sheet 1** **Page 1**

Dimensions in millimetres



Rated voltage	Terminal spacing *P*	Maximum dimensions mm		
V	mm	*W* (width)	*H* (height)	*L* (length)
32	2,5 ± 0,1	7,5	10	8
63	2,5 ± 0,1			8
125	5 ± 0,1			10,5
250 (low-breaking capacity)	7,5 ± 0,15			12,5
250 (intermediate-breaking capacity)	10 ± 0,15			15,0
250 (high-breaking capacity)	12,5 ± 0,15			18

1) The termination must go through a hole 1 mm in diameter. The geometry of the cross-section is optional.

2) Any shape is allowed, as long as the terminations are within tolerance limits for *P* and emerge from the same side of the body.

3) The length '*l*' of the terminations may be adapted for a lead taping type of packaging.

Maximum voltage drop and maximum sustained dissipation: see Table 1.

	Through-hole fuse-links	Standard sheet 1 Page 2

Marking

Fuse-links shall be marked according to the requirements of Clause 6.

Pre-arcing time/current characteristic

The pre-arcing time shall lie within the gates appropriate to the characteristic symbol as specified in 9.2.1.

Breaking capacity

Fuse-links shall be tested as appropriate to their a.c. or a.c./d.c. rating as specified in 9.3.

Rated voltage V	Test current	Overvoltage ** V
32	35 A or 10 I_N *	330
63	35 A or 10 I_N *	500
125	50 A or 10 I_N *	800
250 (low-breaking capacity)	100 A	1500
250 (intermediate-breaking capacity)	500 A	2500
250 (high-breaking capacity)	1500 A	4000

* Whichever is greater.
** These values are maximum values to comply with IEC 60664-1.

Endurance test

100 cycles at 1,05 times the rated current according to 9.4 of IEC 60127-1, followed by 1 h at 1,25 times the rated current.

Maximum sustained dissipation

The maximum sustained dissipation shall be measured at 1,25 times the rated current during the last 10 min of the endurance test and shall not exceed the values specified in Table 1.

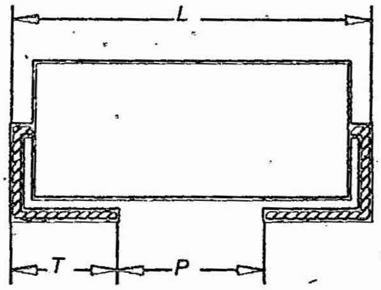
Terminations

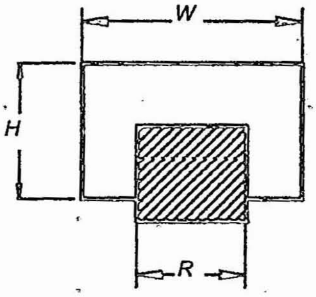
Terminations shall be tested in accordance with 8.3.1.
If the length of the terminations does not exceed 5 mm, the bend test Ub of 8.3.1 is omitted.

10.2 Standard sheet 2 – Surface mount fuse-links

	Surface mount fuse-links	Standard sheet 2 Page 1

Dimensions in millimetres

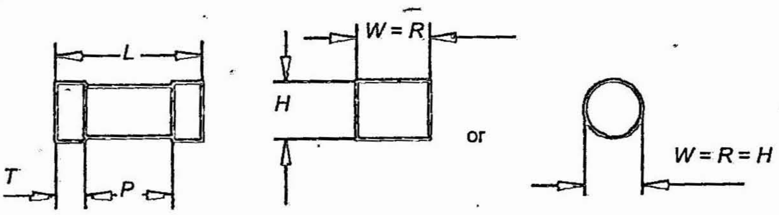




Rated voltage V	Minimum terminal spacing *P* mm	Maximum dimensions		
		W (width) mm	*H* (height) mm	*L* (length) mm
12,5	0,4	1,8	2,5	3,4
25	0,45	1,8	2,5	3,4
32	0,48	6	5	6
50	0,53	6	5	8
63	1,1	6	5	8
125	1,3	6	5	10
250 (low-breaking capacity)	4	Under consideration	Under consideration	12,5
250 (intermediate-breaking capacity)	4			15,8
250 (high-breaking capacity)	4			18

1) Any shape is allowed, the point at which the terminations protrude from the body is optional, and the termination may vary.

Some alternative shapes are shown below:



2) Dimensions *T* and *R* are not specified, but are required to calculate the land sizes for the test board.

Maximum voltage drop and maximum sustained dissipation: see Table 1.

Remark: The terminal spacing *P* has been chosen according to IEC 60664-1 taking into account pollution degree 2 and overvoltage category II (stress less than 1 500 h).

	Surface mount fuse-links	Standard sheet 2 Page 2

Marking

Fuse-links shall be marked according to the requirements of Clause 6.

Pre-arcing time/current characteristic

The pre-arcing time shall lie within the gates appropriate to the characteristic symbol as specified in 9.2.1.

Breaking capacity

Fuse-links shall be tested as appropriate to their a.c. or a.c./d.c. rating as specified in 9.3.

Rated voltage V	Test current	Overvoltage ** V
12,5	35 A or 10 I_N *	Under consideration
25	35 A or 10 I_N *	Under consideration
32	35 A or 10 I_N *	330
50	35 A or 10 I_N *	500
63	35 A or 10 I_N *	500
125	50 A or 10 I_N *	800
250 (low-breaking capacity)	100 A	1500
250 (intermediate-breaking capacity)	500 A	2500
250 (high-breaking capacity)	1500 A	4000

* Whichever is greater.

** These values are maximum values to comply with IEC 60664-1.

Endurance test

100 cycles at 1,0 times the rated current according to 9.4 of IEC 60127-1, followed by 1 h at 1,25 times the rated current.

Maximum sustained dissipation

The maximum sustained dissipation shall be measured at 1,25 times the rated current during the last 10 min of the endurance test and shall not exceed the values specified in Table 1.

Terminations

Terminations shall be tested in accordance with 8.3.2.

60127-4-IEC

Annex A
(informative)

Mounting for surface mount fuse-links

The test fuse-links may be submitted to the test house already soldered to the test boards; however, some tests require fuses to be loose, e.g. "solderability" and "resistance to soldering heat" tests, while through-hole type "bend testing" has to be carried out before soldering. While it is considered acceptable for the test house to be able to solder the through-hole types to the test board for subsequent measurement of voltage drop, there is a difficulty with soldering the SMD fuse-links that have been subjected to resistance to soldering heat onto a test board so that the voltage drop can be tested.

The following is taken from 8.3.3 "Mounting method for pull-off, push-off and shear" of IEC 60068-2-21.

When the details of mounting are not prescribed by the relevant specification, the method of mounting shall be as follows:

a) Choice of solder paste

   1) A solder paste, made from solder as specified in Annex B of IEC 60068-2-20 (see note 1 below) or 63 % tin and 37 % lead may be used and mildly activated flux (see note 2 below) as specified in Annex C of IEC 60068-2-20. Silver (2 % or more) can be added in accordance with the relevant specification. The contamination limits of the solder shall comply with ISO 9453.

   NOTE 1 The solder has the following composition: tin 59 % to 61 %; antimony 0,5 % maximum; copper 0,1 % maximum; arsenic 0,05 % maximum; iron 0,02 % maximum; remainder lead.

   NOTE 2 The activated flux has the following composition: colophony 25 g; 2 propanol (iso-propanol) or ethyl alcohol 75 g; diethylammonium chloride 0,39 g.

   2) The viscosity of the solder paste shall be in accordance with the relevant specification.

   3) The particle mesh size of the solder paste shall be 160 or finer.

   4) The footprints shall be covered with solder deposit. The thickness of the solder deposit shall be between 100 µm and 250 µm; the thickness shall be specified in the relevant specification.

b) Preparation of the specimen

   1) The specimen surface to be tested shall be in the "as received" condition and shall not be touched by fingers or otherwise contaminated.

   2) The specimen shall not be cleaned prior to test. If required by the relevant specification, the specimen may be immersed in an organic solvent at room temperature for preconditioning.

   3) Preconditioning

   Specimens, which need preconditioning, shall be pre-treated in accordance with the relevant specification.

c) Positioning of the specimen

   The specimen shall be placed symmetrically on its footprint.

d) Preheating

   The substrate with the mounted specimen shall be preheated for 60 s to 120 s at 150 °C ± 10 °C, unless otherwise specified.

e) Soldering

  1) Soldering shall be performed immediately after preheating.
  2) As long as the soldering conditions do not lead to a thermal load, which exceeds the SMD specification, any kind of reflow oven or vapour phase soldering oven may be used.
  3) The solder temperature shall be between 215 °C and 235 °C and the time at the peak temperature shall not exceed 10 s. During soldering the total time above 185 °C shall be 45 s minimum.
  4) Care shall be taken that complete wetting is achieved.
  5) The soldered area of the substrate shall be cleaned using 2-propanol (iso-propanol) or water to remove surplus flux. If necessary, the details of the cleaning method shall be specified in the relevant specification.
  6) The solder fillet shall comply with the minimum requirements for the relevant joint given in IEC 61191-2.

Bibliography

IEC 60115-1:1999, *Fixed resistors for use in electronic equipment – Part 1: Generic specification*
Amendment 1 (2001)

IEC 60115-8:1989, *Fixed resistors for use in electronic equipment – Part 8: Sectional specification: Fixed chip resistors* (withdrawn)

IEC 61191-2:1998, *Printed board assemblies – Part 2: Sectional specification – Requirements for surface mount soldered assemblies*

IEC 60326-3:1991, *Printed boards – Part 3: Design and use of printed boards*

ISO 9453:1990, *Soft solder alloys – Chemical compositions and forms*

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(Continued from second cover)

International Standard	*Title*
IEC 60068-2-58 : 2004	Environmental testing — Part 2-58: Tests — Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)
IEC 60194 : 1999	Printed board design, manufacture and assembly — Terms and definitions
IEC 61249-2-7 : 2002	Materials for printed boards and other interconnecting structures — Part 2-7: Reinforced base materials clad and unclad — Epoxide woven E-glass laminated sheet of defined flammability (vertical bruning test), copper-clad

Only the English language text has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the IEC Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments Issued Since Publication

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